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INTENSITY AND STRUCTURE OF RESEARCH AND DEVELOPMENT IN THE CZECH AND SLOVAK REGIONS

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ABSTRACT

Research and development (R&D) is perceived as an important source for new innovation and innovation is the key driving force for economic development and competitiveness. This article deals with characteristics of research and development in the Czech and Slovak regions. Both states have common history, similar socio-economic conditions and similar problems. The aim of the article is to assess and compare the intensity and structure of R&D in the regions. It was confirmed that in both countries research activity is concentrated in the capital cities (Prague and the Bratislava Region) and the South Moravian Region. The expenditures on R&D reach 2 % of gross domestic product in the Czech Republic and 0,89 % in Slovakia, which is below the average of the EU countries. The intensity of R&D in this article is evaluated through the $I_{\mathrm{R\&D}}$ index and using the cluster analysis the regions are divided into three groups. The $I_{\mathrm{R\&D}}$ index confirmed higher intensity of R&D in the Czech regions. The evaluation of the R&D structure is based on Quadrant of research orientation and it is supplemented by the share of technical and natural sciences. The best prerequisites for innovations can be expected in regions with Pasteur-type and Edison-type research orientation. Our analysis showed that research activity is lower in Slovakia in general and this fact does not represent good conditions for Slovak competitiveness.

KEY WORDS

research and development, innovation, region, Czech Republic, Slovak Republic

CLASSIFICATION

JEL: R12, O31, O38

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INTRODUCTION

There is a growing consensus in professional and scientific literature that innovations are the key driving force for economic growth, living standard, international competitiveness and regional development [1]. Companies' future growth and market success depend on their ability to make continuous innovations [2]. Maintaining a sustainable competitive advantage is influenced by the ability of firms to introduce innovations [3]. Research and development (R&D) is perceived as an important source for new innovation in enterprises [4-6]. In countries we consider to be the innovation leaders, we can observe a high level of expenditure on research and development [7]. The European Union (EU) aims to increase expenditure on R&D to 3 % of GDP [8]. The highest expenditure on R&D within the EU member states is to be found in Finland, Sweden, and Denmark. The importance of R&D and innovation has also been reflected in the cohesion policy, where it represents the first thematic objective for financing from the Structural Funds [9]. With respect to the source of financing, the expenditures on research and development are classified into public (government + universities), business, foreign and other (non-profit sector). Statistical offices in Europe monitor research characteristics, also by the field of science. From this point of view, natural sciences, engineering and technology, medical sciences, agricultural sciences, social sciences and humanities are observed [10]. It is generally accepted that especially the technical and natural sciences have significant impact on innovations.

The role of R&D in development of innovation is also broadly discussed in scientific literature. In particular, we can mention the concept of national and regional innovation systems, which investigates individual elements of innovation systems and mutual relations among them. Protagonists of this concept analyse for instance R&D intensity or presence of research organizations and they give recommendations for research and innovation policy [11-13]. The more broadly oriented concept of national innovation capacity perceives R&D as one of the building blocks for innovation ability [14]. The scientific literature discusses the fact that due to market imperfections companies invest less capital in R&D. The main reason for this is the existence of market failures (non-appropriability, non-divisibility, information asymmetry, and uncertainty), which cause that the equilibrium level of resources allocated to R&D is lower than the socially optimal level [15-17]. Therefore, one of the aims of research and innovation policy is to alleviate these market failures and to enhance private investments in research, development, and innovation [18]. Additionally, the innovation systems concept emphasises the system failures that are related to institutions, coordination, and linkages [19]. Woolthius et al. [20] categorized them into infrastructure, institutional, interactive, and ability failures.

We can draw a distinction between two types of research. The first of them is basic research which means theoretical or experimental work, whose purpose is to obtain new knowledge on fundamental phenomena that are not primarily aimed at practical use. The second type is applied research which means theoretical or experimental work aimed at obtaining new knowledge for development of new or improved products, processes or services. In other words, although the main purpose of both basic and applied research is to acquire new knowledge, the applied research is expected to be soon exploited in practice (market). In developed countries, the basic research represents a lower share of total R&D expenditures than the applied research [5]. Based on this typology we can distinguish four types of research orientation of countries or regions [21-23]:

- Bohr-type is fundamental research, which might result in sizeable new-to-the-world discoveries. This research is not intended to be used in the form of innovations in short time. It represents especially the basic research that needs further research and development. It can lead to radical innovation in long-term period,

- Edison-type is research motivated by market needs and the pursuit of profits. It is represented by applied research, whose results have clear economic applications,
- Pasteur-type is research driven by science, but with underlying considerations for its practical use. It represents a situation where basic as well as applied research are involved,
- low research orientation means that the level of basic and applied research in region is not high.

These four types of research orientation together create a quadrant model of research orientation (so-called Pasteur's Quadrant).

The aim of this article is twofold. The first objective is to assess and compare intensity of research and development in the Czech and Slovak regions. For this purpose we proposed our own methodology and subsequently the R&D index is calculated. The second objective of this article is to assess and compare the structure of research and development in the same regions. This evaluation is based on the Pasteur's Quadrant.

The article is structured as follows: Firstly, the research systems in both countries are briefly described. Then we explain the aim of the article and the methods that we have used. Afterwards, the results with respect to the intensity and structure of R&D are presented. The conclusion summarizes the main results.

R&D SYSTEM IN THE CZECH REPUBLIC AND SLOVAKIA

The Czech Republic (CR) and Slovakia constituted one national state called Czechoslovakia till 1992. Both countries have many common features and they have similar historical, social, cultural, and economic characteristics. Both countries cooperate intensively in economic, educational and research fields.

The contemporary state of R&D in the Czech Republic and Slovakia is partly influenced by decades of central planned economics and things that occurred after the Velvet revolution in 1989. Although some problems have been reduced (especially within the last 10 years when growing attention has been paid to research and innovation), some deficiencies persist. The impact of central planning is clearly visible in the case of united Germany, where it is possible to observe big differences between East and West Germany, in particular in relation to business expenditures on R&D [24]. The low level of basic and applied research and low degree of cooperation between them is analyzed by Blažek and Uhlíř [25]. Before 1989 a high share of applied research in Czechoslovakia was conducted in research centres of big companies owned by the state. These companies were privatised after 1989 and new owners closed their research centres. The main effort of these privatised companies was to survive, not to innovate. Furthermore, if the new owners came from abroad, they had better and modern technologies. That is the reason why most of corporate research centres were closed. Of course we can find several cases, when the foreign owner kept the research department, but they are only exceptional examples and this phenomenon occurred in traditional strong industries such as automotive industry, electronics, ICT and mechanical engineering. Independent research institutes dealing with applied research owned by the state were privatised too and they usually did not manage to adapt to new conditions and absence of public aid. A weak relationship between basic and applied research was caused by the situation at the Academy of Sciences and universities. The Academy of Sciences focuses on basic research and Czech and Slovak universities aimed particularly at education in the 1990s. Nobody expected them to bring research results that would be useful for practical use.

Due to shared history they have a similar research supportive system. Important roles are played by the Ministries of Education, but the role of the Slovak Ministry is slightly more complex. Furthermore, a new Ministry of Science will be established in the Czech Republic in 2017. The CR has one supporting agency specialized in basic research (Czech Science Foundation GACR, founded in 1993) and another one specialized in applied research (Technology Agency TACR, founded in 2010). Both of them were established by the act on support of R&D, they are fully independent of the Ministry of Education and are financed directly from the state budget. In Slovakia, basic as well as applied research are supported by the Slovak Research and Development Agency SRDA (founded in 2005), which is financed through the Ministry of Education. Additionally, this Ministry has established the Scientific Grant Agency VEGA and internal Cultural and Educational Grant Agency KEGA. Both Ministries of Education play the role of the managing authorities of operational programmes that support R&D from the European Structural Funds. Furthermore, the Slovak Ministry has established the Research Agency which has the function of an intermediate body for the operational programme. Besides universities, the public basic research is conducted by Academies of Science in both countries.

AIM AND METHODS

The aim of our article is to assess and compare the intensity and structure of research and development in the Czech Republic and Slovakia. The evaluation is carried out at the level of NUTS 3 regions (14 regions in the CR and 8 regions in Slovakia). These regions represent self-governing territorial units, i.e., elements existing between national states and municipalities. In order to be able to compare the regions it is necessary to design appropriate indicators first.

To be able to evaluate the **intensity of R&D**, it is necessary to choose indicators (variables) that are available and suitable for this purpose. Consequently, the values of selected variables have to be normalized, because they are expressed in various units. The normalization formula is:

$$x' = \frac{x-m}{\sigma}, \tag{1}$$

where the sign of the centred value $x - m$ represents an above-average or a below-average value of the i-th value of x; the normalized value says by how many standard deviations (σ) the value x is deflected above/below the average. If all indicators have the same weight, the normalized values have to be rescaled [26]:

$$x = \frac{x-\min(x)}{\max(x)-\min(x)}. \tag{2}$$

The rescaled values of indicators can be used to calculate the R&D index ($I_{\mathrm{R\&D}}$). This index is defined as:

$$I_{R\&\mathrm{D}} = \sum_{i=1}^{n} x_i \ , \tag{3}$$

where n represents the number of selected indicators.

The rescaled values can be used for cluster analysis as well. Through this analysis we can group the regions into clusters based on their similarity. The non-hierarchical method of k-means with Euclidean distance is used.

The **R&D structure** in the Czech and Slovak regions is evaluated through another set of relevant indicators. We draw inspiration from the Pasteur's Quadrant of research orientation (Figure 1). Individual regions are classified into four quadrants based on the degree of basic and applied research. We do not consider this evaluation to be sufficient, therefore we add one more indicator.

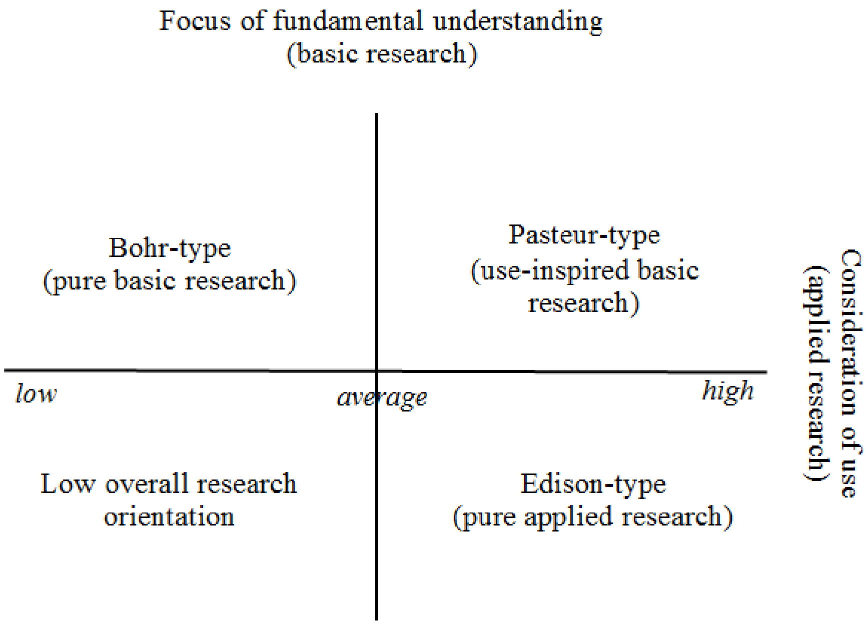

Figure 1. Quadrant model of research orientation [22, 23].

RESULTS

Four indicators have been selected for the evaluation of **intensity of R&D** in the CR and Slovakia. These indicators represent the key aspects of R&D. The indicators are as follows:

- EMP: the number of R&D personnel in full time equivalent (FTE) per 1000 employees in regional economy,
- RDE: the total expenditure on R&D expressed as a share of regional GDP (%),
- BES: the share of business expenditures in the total R&D expenditures (%),
- BEE: the business R&D expenditures expressed as a share of regional GDP (%).

The R&D index is calculated on the basis of EMP, RDE and BEI subindex. The BEI subindex is defined as a sum of rescaled and normalized values of BES and BEE.

Three other indicators have been selected for the evaluation of **R&D structure** in the Czech and Slovak regions. The indicators are as follows:

- BRE: the basic research expenditures expressed as a share of regional GDP (%),
- AEE: the expenditures on applied research and development expressed as a share of regional GDP (%),
- NST: the share of expenditures on natural sciences and engineering and technology in the total R&D expenditures (%).

We used statistical data for 2014 published by the Czech Statistical Office [27, 28] and Statistical Office of Slovak Republic [29, 30]. These statistical surveys and definitions used fully comply with methodological principles of the OECD [10]. Table 1 shows the values of the indicators.

Table 1. R&D characteristics in the Czech and Slovak regions in 2014 [27-30].

Region	EMP, no.	RDE, %	BES, %	BEE, %	BRE, %	AEE, %	NST, %
Prague (CZ010)	36,03	2,86	37,15	1,06	1,26	1,60	75,12
Central Bohemian (CZ020)	8,81	2,01	74,42	1,49	0,21	1,80	96,39
South Bohemian (CZ031)	7,34	1,14	55,32	0,63	0,44	0,70	85,87
Pilsen (CZ032)	11,39	2,15	56,56	1,21	0,35	1,80	89,26
Karlovy Vary (CZ041)	1,12	0,18	93,98	0,17	0,01	0,18	99,20
Usti (CZ042)	3,04	0,48	52,26	0,25	0,09	0,38	77,73
Liberec (CZ051)	10,49	1,89	64,07	1,21	0,26	1,63	98,31
Hradec Kralove (CZ052)	7,01	1,04	51,26	0,54	0,15	0,90	58,13
Pardubice (CZ053)	10,47	1,61	72,05	1,16	0,27	1,34	94,57
Vysocina (CZ063)	4,17	0,88	85,44	0,75	0,05	0,83	98,33
South Moravian (CZ064)	21,60	3,66	47,39	1,73	1,15	2,51	81,60
Olomouc (CZ071)	11,04	1,69	40,55	0,68	0,84	0,85	64,45
Zlin (CZ072)	7,05	1,29	65,50	0,85	0,11	1,18	93,18
Moravian-Silesian (CZ080)	7,80	1,26	58,24	0,73	0,46	0,80	91,22
Bratislava (SK010)	26,10	1,48	31,73	0,47	0,68	0,62	65,11
Trnava (SK021)	3,90	0,56	28,80	0,16	0,16	0,19	79,75
Trencin (SK022)	4,12	0,78	59,88	0,46	0,08	0,66	97,89
Nitra (SK023)	5,15	0,64	21,07	0,13	0,20	0,35	20,67
Zilina (SK031)	4,30	0,93	33,83	0,32	0,16	0,49	70,77
Banska Bystrica (SK032)	4,67	0,53	35,08	0,19	0,15	0,29	70,09
Presov (SK041)	2,09	0,35	38,06	0,13	0,09	0,22	84,76
Kosice (SK042)	7,67	0,75	16,81	0,13	0,41	0,13	60,24

INTENSITY OF RESEARCH AND DEVELOPMENT

Research and development can be characterized by highly qualified employees, both researches and other personnel. Their number in full time equivalent reflects the importance of R&D in the region. Figure 2 shows that the highest number of personnel is in Prague (CZ010). With a gap it is followed by the Bratislava (SK010) and South Moravian (CZ064) Regions. Fewer than 5 persons in R&D per 1000 employees were identified in 8 regions, the lowest numbers were observed in the Presov (SK041) and Karlovy Vary (CZ041) Regions.

The total expenditures on R&D expressed as a share of GDP (in %) are commonly used for interregional comparisons. Expenditures on R&D are considered to be an important prerequisite for competitiveness increase; therefore, there is a natural requirement for their sufficient volume. The South Moravian Region dominates considerably in the ranking of the Czech and Slovak regions. This is particularly caused by the support from the cohesion policy. This region is followed by Prague, the Pilsen and Central Bohemian Regions (their expenditures exceed 2 % of GDP). The highest values within the Slovak regions were observed in the Bratislava (1,48 %) and Zilina (0,93 %) Regions. Figure 3 shows the positions of individual regions.

As regards indicators expressing the share of business and public expenditures on R&D, they reflect the structure of research organizations and tradition of in the regions. If public research institutes and public universities are present in the region, the share of basic research as well as public resources is usually higher. The business expenditures on R&D represent the activity of the business sector. The results of this research can be often put to the market. Developed

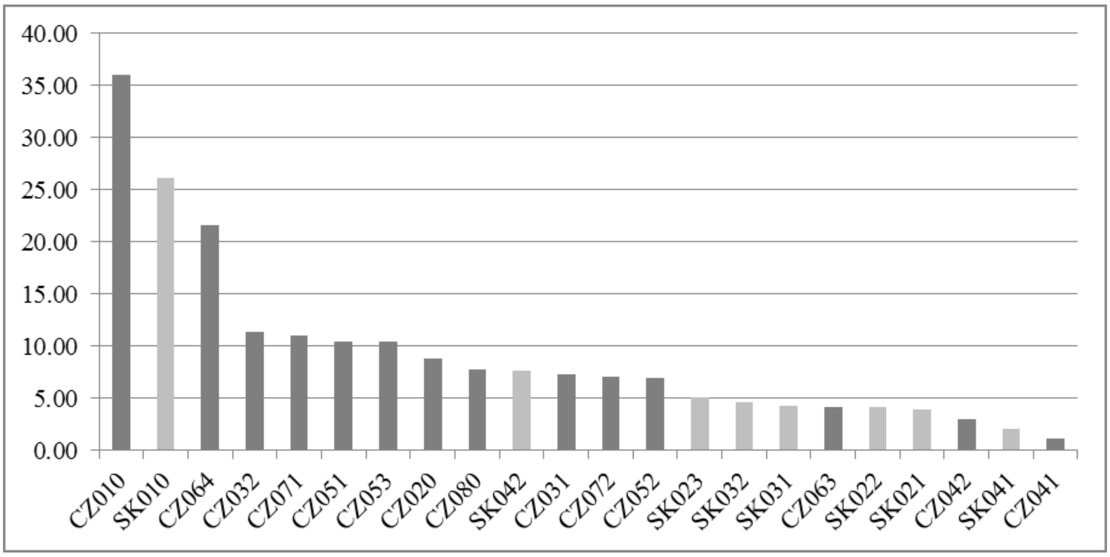

Figure 2. The number of R&D personnel in full time equivalent (FTE) per 1000 employees in the Czech and Slovak regions (2014) [27-30].

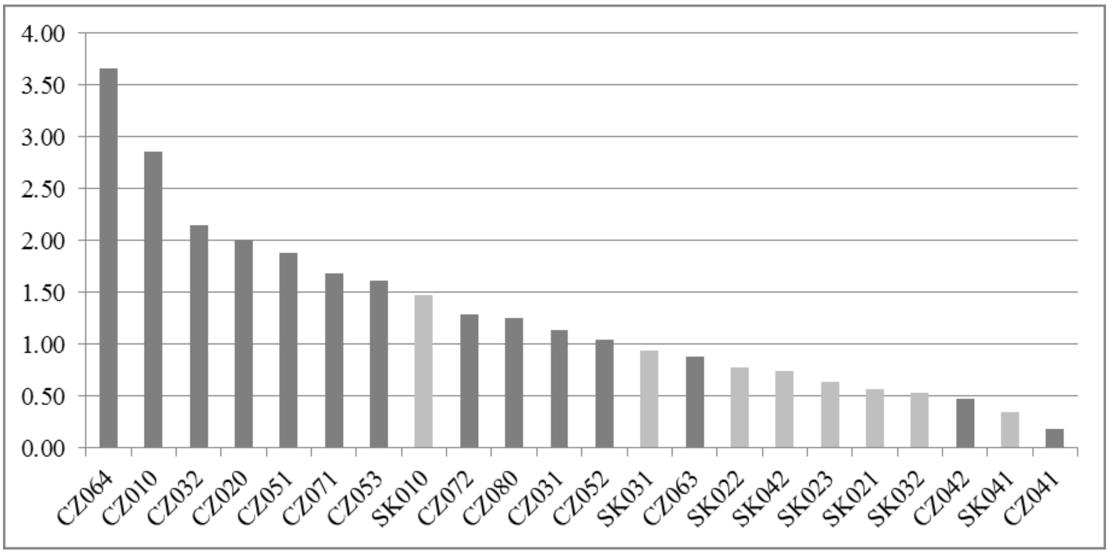

Figure 3. The total expenditures on R&D expressed as a share (in %) of GDP in the Czech and Slovak regions (2014) [27-30].

European regions have usually a high share of these expenditures [31]. The share of business expenditures in the total R&D expenditures (BES indicator) can be influenced by the presence of public research. If there are no (or few) public universities and research institutes, it is apparent that the share of business expenditures has to be high. Furthermore, a high share of business expenditures (as % of total R&D expenditures) does not mean that the region has high business expenditures in absolute values. Therefore, we take into consideration the share of business expenditures in regional GDP (BEE indicator) as well. As we can see in Table 1, the values of both indicators (BEE and BES) are often different. For instance, the value of BES in Prague is only 37,15 %, but its BRE is 1,26 %. On the contrary, the value of BES in the Karlovy Vary Region is 93,98 %, but its BRE is only 0,17 %. High values of both indicators have been observed in the Central Bohemian, Pardubice, Liberec and Vysocina Regions.

In accordance with the above mentioned methodology, the values of the selected indicators were normalized into dimensionless numbers and then rescaled to take values between zero and one (0 is the minimum value, 1 is the maximum value – Table 2).

Table 2. Normalized and rescaled values of R&D in the Czech and Slovak regions (2014) [27-30].

Region	EMP	RDE	BEI		Region	EMP	RDE	BEI
CZ010	1,00	0,77	0,52		**CZ071**	0,28	0,43	0,41
CZ020	0,22	0,53	1,00		**CZ072**	0,17	0,32	0,69
CZ031	0,18	0,28	0,52		**CZ080**	0,19	0,31	0,58
CZ032	0,29	0,57	0,74		**SK010**	0,72	0,37	0,25
CZ041	0,00	0,00	0,69		**SK021**	0,08	0,11	0,12
CZ042	0,06	0,08	0,35		**SK022**	0,09	0,17	0,50
CZ051	0,27	0,49	0,81		**SK023**	0,12	0,13	0,04
CZ052	0,17	0,25	0,45		**SK031**	0,09	0,22	0,22
CZ053	0,27	0,41	0,86		**SK032**	0,10	0,10	0,18
CZ063	0,09	0,20	0,82		**SK041**	0,03	0,05	0,19
CZ064	0,59	1,00	0,85		**SK042**	0,19	0,16	0,00

On the basis of indicators' values in Table 2 we can calculate the R&D index, whose maximum value can reach 3. Values of R&D index are presented in Table 3, the regions are arranged in accordance with their $I_{R\&D}$ score. In the case of the Czech Republic, the highest value is reached by the South Moravian Region and Prague, the Usti Region has the worst position. In the case of Slovakia, the best results were attained in the Bratislava and Trencin Regions. The other regions have mutually similar scores; the worst score is reached by the Presov and Nitra Regions.

Table 3. R&D index in the Czech and Slovak regions (2014).

Region	$I_{R\&D}$		Region	$I_{R\&D}$		Region	$I_{R\&D}$
CZ064	2,44		**CZ071**	1,13		**SK031**	0,53
CZ010	2,29		**CZ063**	1,11		**CZ042**	0,49
CZ020	1,75		**CZ080**	1,08		**SK032**	0,38
CZ032	1,60		**CZ031**	0,97		**SK042**	0,35
CZ051	1,57		**CZ052**	0,87		**SK021**	0,31
CZ053	1,54		**SK022**	0,75		**SK023**	0,29
SK010	1,34		**CZ041**	0,69		**SK041**	0,26
CZ072	1,18						

The rescaled values are suitable as input data for cluster analysis. When the method of *k*-means is used, the key step is to set the appropriate number of clusters. With respect to the number of regions, number of variables and number of indicators, the number of clusters is set to $k = 3$:

- 1st cluster – Capital city Prague, the South-Moravian, and Bratislava Regions,
- 2nd cluster – the Central Bohemian, South-Bohemian, Pilsen, Karlovy Vary, Liberec, Hradec Kralove, Pardubice, Vysocina, Olomouc, Zlin, Moravian-Silesian and Trencin Regions,
- 3rd cluster – the Usti, Trnava, Nitra, Zilina, Banska Bystrica, Presov and Kosice Regions.

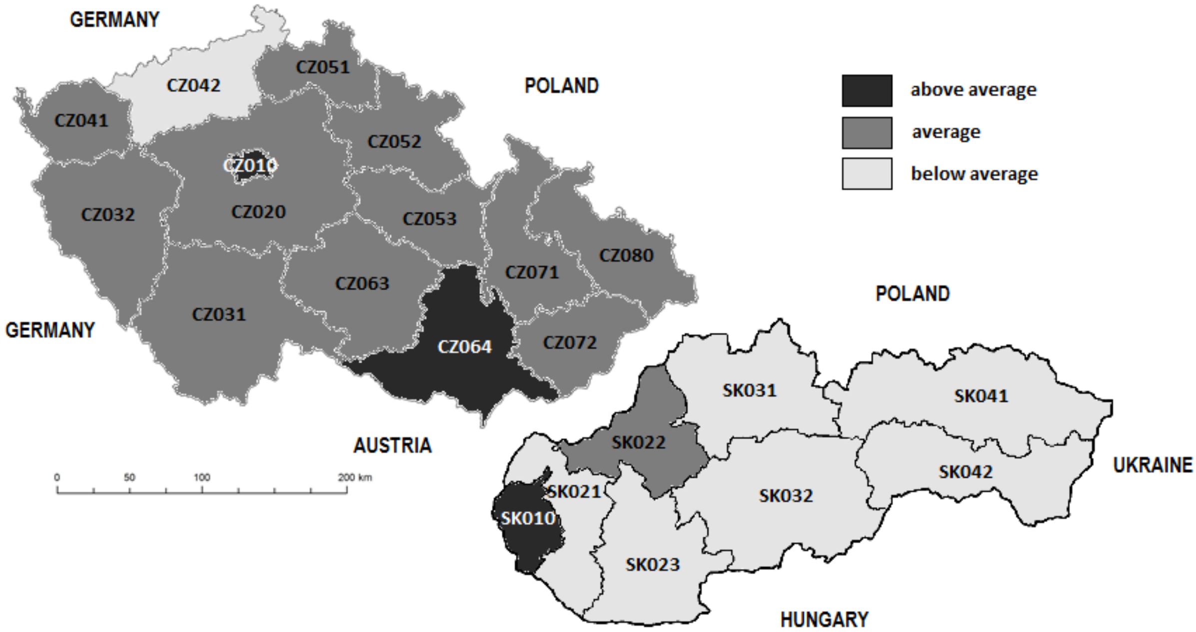

Figure 4. Intensity of R&D in the Czech and Slovak regions (2014).

Based on the cluster analysis the regions are divided into three groups (Figure 4) by their mutual similarity. In general and briefly, they can be characterized in this way:

- the 1st cluster consists of regions with above-average intensity of R&D that have the highest values of EMP and RDE indicators, and a rather lower share of business expenditures,
- the 2nd cluster consists of regions with average intensity of R&D. Twelve regions are classified into this group, 11 of them is Czech, one is Slovak (the Trencin Region). Most of them have above-average value of at least one indicator, mostly the BEI indicator,
- the 3rd cluster consists of regions with below-average intensity of R&D. These regions have a low value of all indicators.

Looking at the classification of regions into clusters, we can say that the Czech regions have a significant representation in the group of average regions (11 out of 14), whereas the Slovak regions are represented mainly in the group of below-average regions (6 out of 8).

STRUCTURE OF RESEARCH AND DEVELOPMENT

Besides the intensity of R&D, we assess the structure of R&D in the Czech and Slovak regions as well. As regards indicators expressing the level of expenditures on basic and applied research as well as expenditures on natural sciences and engineering and technology, they reflect the structure of research organizations and tradition of R&D in the regions. Evaluation of R&D structure is based on Quadrant model of research orientation (Figure 5). Besides the intensity of R&D, we assess the structure of R&D in the Czech and Slovak regions as well. The natural sciences and engineering and technology dominate in most of the regions; however, their proportion is differentiated. It depends on the tradition of other fields, in particular, e.g. agricultural sciences prevail in the Nitra Region.

The graph axes (Figure 5) are intersected at the point of average values of the BRE indicator (0,34 % and the AEE indicator (0,88 %). At the same time they divide the regions into four quadrants in accordance with their research orientation. If the regional code is underlined and in bold, it means that it has above-average (79,66 %) value of the NST indicator. In the Pasteur-type quadrant we can find regions with above-average values of both BRE and AEE indicators. Their structure of R&D can be marked as favourable, because these regions have

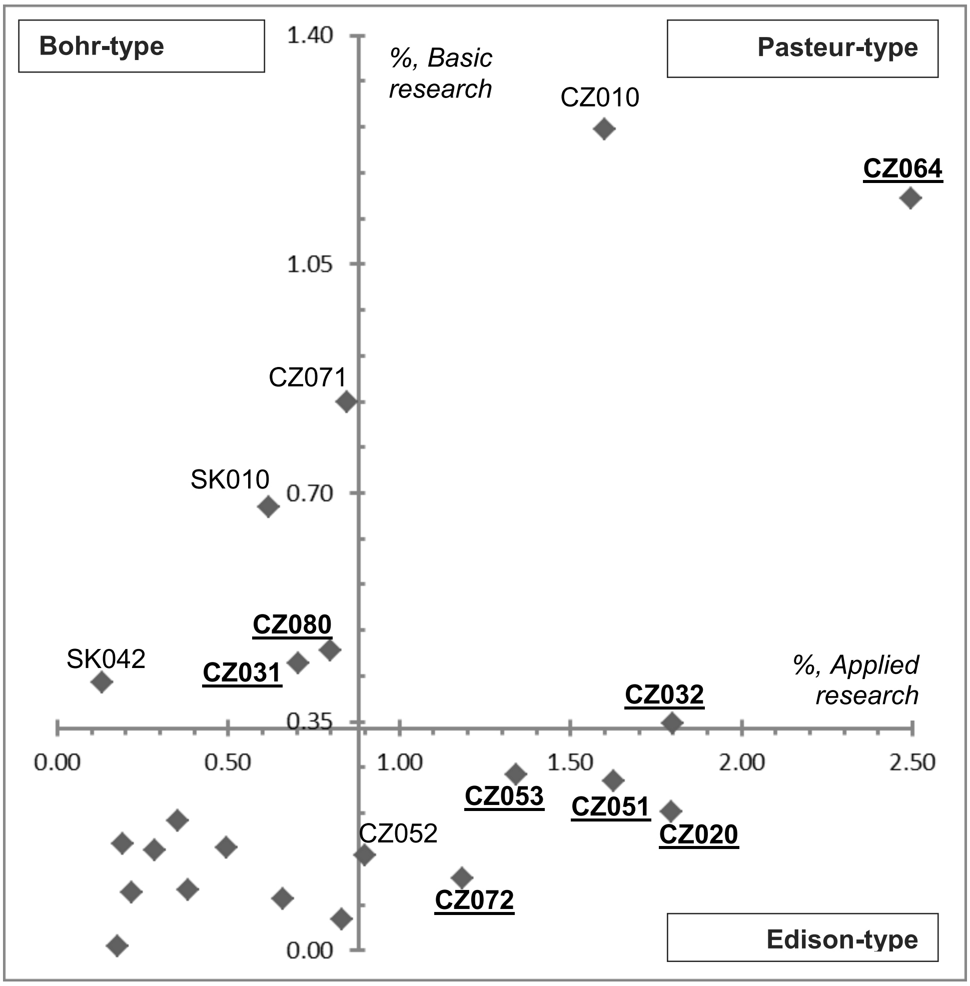

Figure 5. Structure of R&D in the Czech and Slovak regions (2014). Regions with above-average share of NST indicator are underlined and highlighted in bold. Low research orientation – CZ041, CZ042, CZ063, SK021, SK022, SK023, SK031, SK032, SK041 [27-30].

the best prerequisites for creation of incremental and radical innovations. Furthermore, the South Moravian (CZ064) and Central Bohemian (CZ020) Regions have a high share of natural sciences and engineering and technology (NST). In the Edison-type quadrant there are regions with above-average values of AEE and below-average values of BRE. Situation in these regions is quite good too (particularly if they have a high share of NST as well). They have a lower potential for creation of radical innovation, but they can be successful in the area of incremental innovations. Both Pasteur-type and Edison-type of research orientation can bring practical results for the regional innovation system. In the Bohr-type quadrant we can find regions with above-average values of BRE and below-average values of AEE. The main task for these regions is to increase the intensity of applied research so that the research results are more exploitable in practice. The regions in the last quadrant have below-average values of both BRE and AEE indicators. For their future competitiveness it is necessary to increase their expenditures on R&D. It is apparent that these regions do not have potential for radical innovations, therefore they should strive to get to the Edison-type quadrant. Whereas most of the Czech Regions (10 out of 14) reach above-average values in at least one indicator, in Slovakia it is valid only for the Bratislava (SK010) and Kosice (SK042) Regions. The same can be said in the NST case, where the Czech Republic has 10 above-average regions and Slovakia only three. It follows that the Slovak government should increase expenditures on R&D and at the same time it has to create favourable conditions in order to stimulate Slovak enterprises to invest in R&D.

CONCLUSION

The article compares research intensity and structure in the regions of the Czech Republic and Slovakia. Both states have common history and similar socio-economic conditions. This provides a suitable basis for their mutual comparison. The expenditures on R&D in the Czech Republic (2 % of GDP, i.e., 294 EUR per capita) are higher than in Slovakia (0,89 % of GDP, i.e., 124 EUR per capita) [32].

As we assumed, it was confirmed that in both countries research activity is concentrated in the capital cities (Prague and the Bratislava Region) and the South Moravian Region. The absolutely highest expenditures on R&D were observed in the South Moravian Region. This is caused by the support from the Structural Funds in the framework of cohesion policy. By contrast, Prague and Bratislava have limited access to the Structural Funds, because they are in the group of more developed European regions. In comparison with the most developed European states, the research activity in the Czech Republic as well as in Slovakia is quite low.

Our analysis pointed out the fact that research activity is lower in Slovakia than in the CR, which does not represent good conditions for Slovak competitiveness. In our opinion, the Slovak R&D supporting system is less arranged (clear). Slovakia has no institution specialized in support of applied research. In the Czech Republic the Technology Agency has been established for this purpose. It allows concentrating resources for applied research and paying more attention to cooperation between the research and the business spheres. On the other hand, the Czech research system also has a lot of weaknesses. The level of investments in R&D is not sufficient, the research environment is often changed by the government, the level of innovation cooperation is low and invested resources do not bring adequate economic effects yet.

First of all, we evaluated the intensity of research and development. We selected four indicators that were subsequently transformed into the R&D index. The highest values of $I_{\mathrm{R\&D}}$ were observed in the South Moravian, Prague and Central Bohemian Regions. Based on the cluster analysis, the regions were divided into three groups based on their similarities. The 1st cluster contains regions with a high intensity of research activity and it consists of two Czech and one Slovak regions. Regions in the 2nd cluster have average total intensity of R&D, but they usually have at least one above-average indicator. The 3rd cluster consists of Slovak regions predominantly.

The structure of research and development was evaluated in accordance with the quadrant model of R&D orientation. The best prerequisites for radical and incremental innovations were identified in Prague and the South Moravian and Pilsen Regions. The main results of intensity and structure evaluation can be summarized through the matrix (Table 4).

Table 4. Intensity and structure of R&D.

Intensity of R&D	Structure of R&D			
	Pasteur- type	**Edison-type**	**Bohr-type**	**Low research orientation**
1st cluster	CZ010, CZ064	–	SK010	–
2nd cluster	CZ032	CZ020, CZ051, CZ052, CZ053, CZ072	CZ031, CZ071, CZ080	CZ041, CZ063, SK021, SK022, SK023, SK031, SK032, SK041
3rd cluster	–	–	SK042	CZ042

We are aware of the fact that our research has limitations and presents challenges for future research at the same time. We have analysed data for a one-year period. In future we would like to make time series which will be more conclusive. The intensity and structure of R&D in both countries are influenced by history, tradition, and presence of big universities. The future research should also focus on the comparison of research activity and innovation performance of regions.

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